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Binding Technologies to Concepts:
Unleashing the Power of the Information Age

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Abstract

The Commander of a Combatant Command or a Joint Task Force is responsible for an extensive range of missions and activities that span the spectrum from traditional force projection and war fighting responsibilities to non-traditional activities such as Nation Building, Peace Keeping, and Diplomacy. The Combatant Commander has cognizance of hundreds of simultaneous, ongoing activities within the Command. These can include Crisis Operations, Deliberate Planning, Theater Security Coordination, Political/Diplomatic actions, Exercises and Training, Budgeting and Command House Keeping, to name a few. Whereby existing C2 system constructs are optimized for the staff, today's Decision Maker requires a broader "Decision Focused" perspective. CINC21 is an Advanced Concept Technology Demonstration sponsored at Headquarters, U.S. Pacific Command. This paper highlights the contributions of CINC21 to Command and Control, and details the journey of ideas to innovation. Building from operational concepts articulated in Joint Doctrine, pioneering software concepts provide a sufficiently broad set of functionality from which the power of information emerges. The Decision Focused Command and Control (DFC2) is the realization of concept and technology, and is the showcase product of CINC21. DFC2 provides the "Decision Focused" framework required by the Combatant and Joint Task Force Commander. This paper will provide an overview of DFC2 as it applies to Joint Operations, and characterize key elements of the technical architecture. The discussion will explore fundamental issues from the perspective of the operational user, capture the reality of a paradigm shift, and expose the challenges of reinventing business processes supported by a robust knowledge-centric framework.

Technology Focus: Decision Focused Command and Control
The central function of command is decision making. The primary objective of the CINC 21 ACTD is to explore the application of new information technologies and concepts for their use that would enhance the ability of a combatant commander to make effective decisions. CINC 21 OM and TM staffs studied the implications of commander decision making through the observation of operations at PACOM and Strategic Command (STRATCOM) headquarters and through interviews with both incumbent and former commanders and their staffs. This research led to several key observations concerning decision making at the combatant commander level:

- Timely decision making is essential to the commander. In making the correct decision at the right time, the commander maintains the initiative in the operation, staying ahead of and shaping events;

- Decisions must be viewed within the context of the commander's objectives and goals. Achieving the goals of the operation are paramount in the commander's mind and these goals must be clearly articulated, related to operational plans, and commonly understood by the RCC staff and supporting forces;

- The major function of the staff is supporting the commander's decision making process. While this process may vary from commander to commander, the type of operation being conducted, and other factors outside the bounds of the operation, the single constant is the need for the staff to channel its resources around the task of preparing the commander to make key decisions.

In addressing these essential insights relative to command and control at the RCC commander (CDR) levels, the CINC 21 ACTD undertook the development of a set of information technology tools intended to support the RCC CDR and staff in their interactions one echelon up and down as well as with peers. This development was undertaken in two basic efforts. The first was the development of an information infrastructure that supported access to information at the local level and sharing the information across all components in the theater. This infrastructure was first used to support the process of situational awareness within the RCC headquarters' Joint Operations Center (JOC), through a series of "Ops Packages" and supported tasks such as message processing, briefing development, and information queries. The second was the development of a decision making architecture capable of focusing the CDR's attention on the next decision to be made. This architecture, developed as CINC 21 Decision Focused Command and Control (DFC2), would integrate and format information and recommendations into views designed to guide the CDR or other RCC decision maker to a timely and appropriate operational decision.

The DFC2 architecture is built around the concept of a *Decision Space,* a virtual, collaborative environment where the headquarters staff will collect and analyze information in order to support the CDR's decision making process. Accessed via a web browser, the Decision Space will support the staff and commander in three interrelated processes: decision shaping, information production and analysis, and execution management. The DFC2 Decision Space will provide access to the tools to support these processes, including information access and processing, workflow management, and collaboration. The centerpiece of the Decision Space is the *Executive Summary*. The Executive Summary is a composable presentation of the essential information and analysis relating to an upcoming decision, tailored to the individual staff members, from junior watchstander to CDR. Through DFC2's Executive Summaries, information is gathered within the Decision Space, analyzed along with the requirements of the mission, and shaped into recommendations for the CDR.

The flexibility of the DFC2 architecture and the Decision Space construct is intentional, not only because different headquarters have varied responsibilities driving their decision making processes, but also because the nature of decision making changes from situation to situation. With this change comes the shift in responsibilities within the decision making process. Various members of the headquarters staff will be engaged as the principal in decision shaping, information gathering and analysis, and decision making according to the situation. The DFC2 addresses this with the concept of a *Decision Context* aligning decision shaping activities to the creation and maintenance of the CDR's Executive Summary on a continual basis. How this Decision Context will be managed is the subject of the remainder of this operational concept.

Importance and Role of an Operational Concept in DFC2 Development
The development of an operational concept, hand in hand with technology development, is critical to the successful realization of the technology's potential through the evolution of new and more effective business practices. In practical terms, the operational concept effort must be seen as the "front end" of a process for the iterative development of the technology and its integration into the operational environment. Ideally this process would see the first development of an operational concept with initial technology development efforts, presenting the potential user with a hypothetical application of the technology to critical user needs.

Because the operational concept evolves with technology development and implementation, its development must be planned and resourced throughout the lifespan of the development effort. The operational concept will change in both form and content as the technology is used and improved. Early operational concepts will be general and geared towards bringing the user into the technology development process. As the technology is developed and the user is exposed to its capability, the operational concept will become more precise, with its final form being a direct input to the drafting of precise training and user manuals. This operational concept is at the early end of this spectrum, intended to provide a first attempt at guiding the integration of CINC 21 technologies into the command processes at a combatant commander's headquarters. As the CINC 21 technologies evolve in their use, the associated operational concept will eventually be incorporated into the standard operating procedures (SOPs) at the RCC headquarters employing them.

Putting the Commander at the Center of Decision Making
The key to the DFC2 approach is the realization that a military plan outlines a mission as a series of phases, each composed of distinct tasks that essentially serve as building blocks. These "building blocks" are interrelated and mutually supporting: managing their accomplishment is the essence of command and control at any level, with the RCC theater level the most complex. This complexity is the result of several factors. Understanding the state of accomplishment of a plan is difficult, as information pertaining to ongoing operations is often fragmented and incomplete. The suitability of the plan is geared towards assumptions made by planners and these assumptions may be proven wrong during the course of operations. Finally, theater operations are multidimensional, shifting the attention of the CDR and staff from issue to issue. As research done in support of the CINC 21 ACTD indicates, alerting the CDR to those instances when his or her personal intervention and decision is required is a persistent but elusive requirement for adequate command and control. The key to this decision focused paradigm is the realization that a military plan outlines a mission as a series of phases, each composed of distinct tasks that essentially serve as building blocks. These "building blocks" are interrelated and mutually supporting: managing their accomplishment is the essence of command and control at any level, with the RCC theater level the most complex.
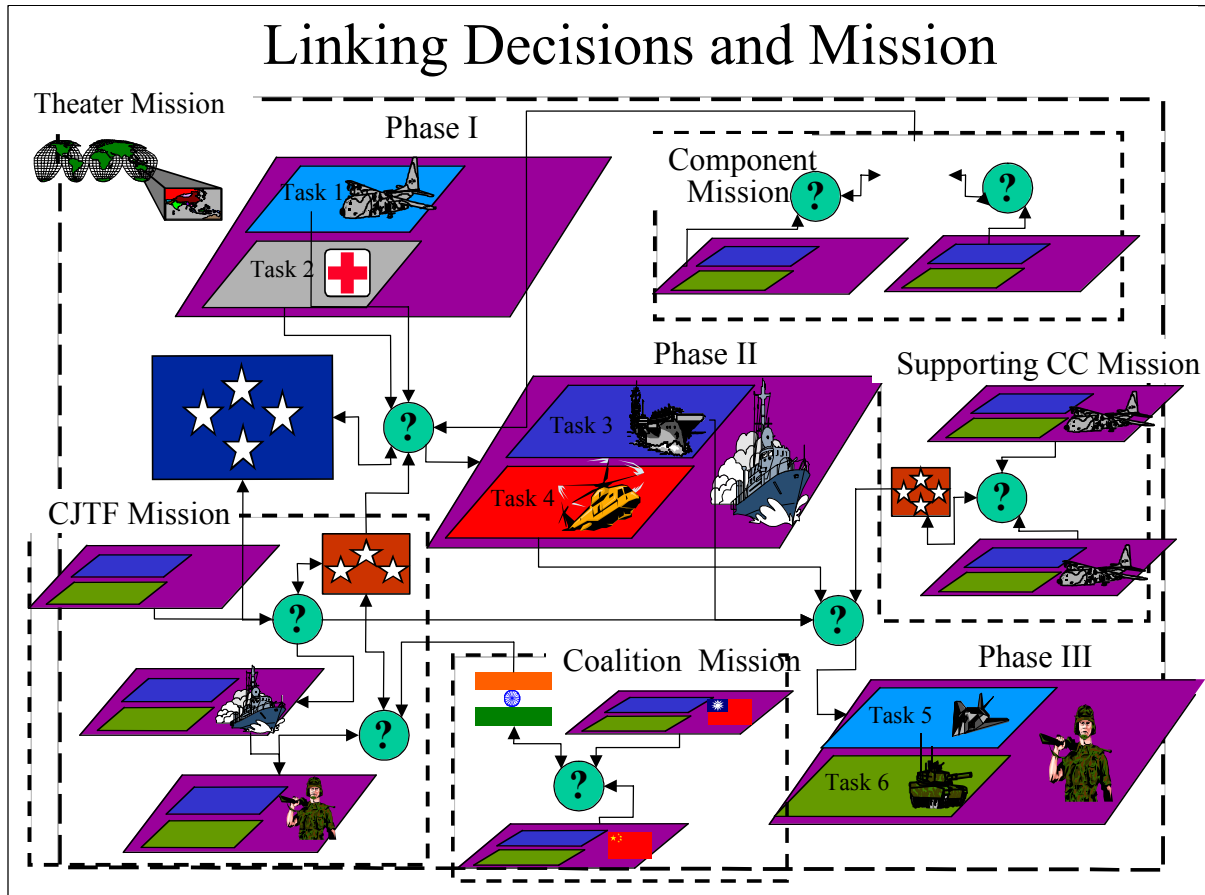
Figure I-1

In order to implement the decision focused paradigm, the planning process for a mission must begin with the deconstruction of the mission into a series of tasks and the arraying of these tasks into phases. A decision focus in this part of the planning process, referred to as *mission analysis* and c*ourse of action (COA) development,* will include the establishment of decision points as part of the phase descriptions and will further call for planners to describe the conditions and information needs required to satisfy each decision point.

The adoption of the Decision Point (DP) framework is a foundation for the DFC2 concept. Although a relatively recent convention, the DPs' role in operational planning and execution monitoring is enabled by the DFC2 technologies. In the DFC2 framework, DPs are directly linked to *Commander's Critical Information Requirements (CCIRs),* with CCIRs essentially providing the criteria for the CDR's assessment at each DP. CCIRs are a common tool for headquarter staffs, earmarking those information requirements with the CDR's interest. The DFC2 concept takes this construct a step further in providing the tools to allow the staff to monitor the wide range of CCIRs necessary to characterize the state of the operation based on plan accomplishment. This accomplishment is mapped by the DPs. Figure I-2 summarizes the relationships between the planning process products (mission analysis, COA, etc.) and CCIRs and DPs.

Several clarifying points must be made relative to the nature of DPs and CCIRs. DPs must reflect the CDR's explicit direction for command and control of the operation, usually summarized in the *Commander's Intent* statement. The CDR will ultimately approve the DPs although they will be crafted by different members of the staff as indicated below. CCIRs must similarly reflect the CDR's priorities and under the DFC2 concept, be directly related the DPs. CCIRs come in several varieties: Priority Information Requirements (PIRs), Essential Elements of Friendly Information (EEFIs) Essential Elements of Information (EEIs), Friendly Force Information Requirements (FFIRs). The responsibility for monitoring each type of CCIR will vary with its type, complicating the integration of the information necessary to evaluate a DP. Furthermore, it is expected that each DP will have multiple CCIRs associated with it, and each CCIR may be associated with more than one DP. Managing this sophisticated process of information collection and analysis is the focus of the DFC2 technologies and the primary function of the Decision Space.
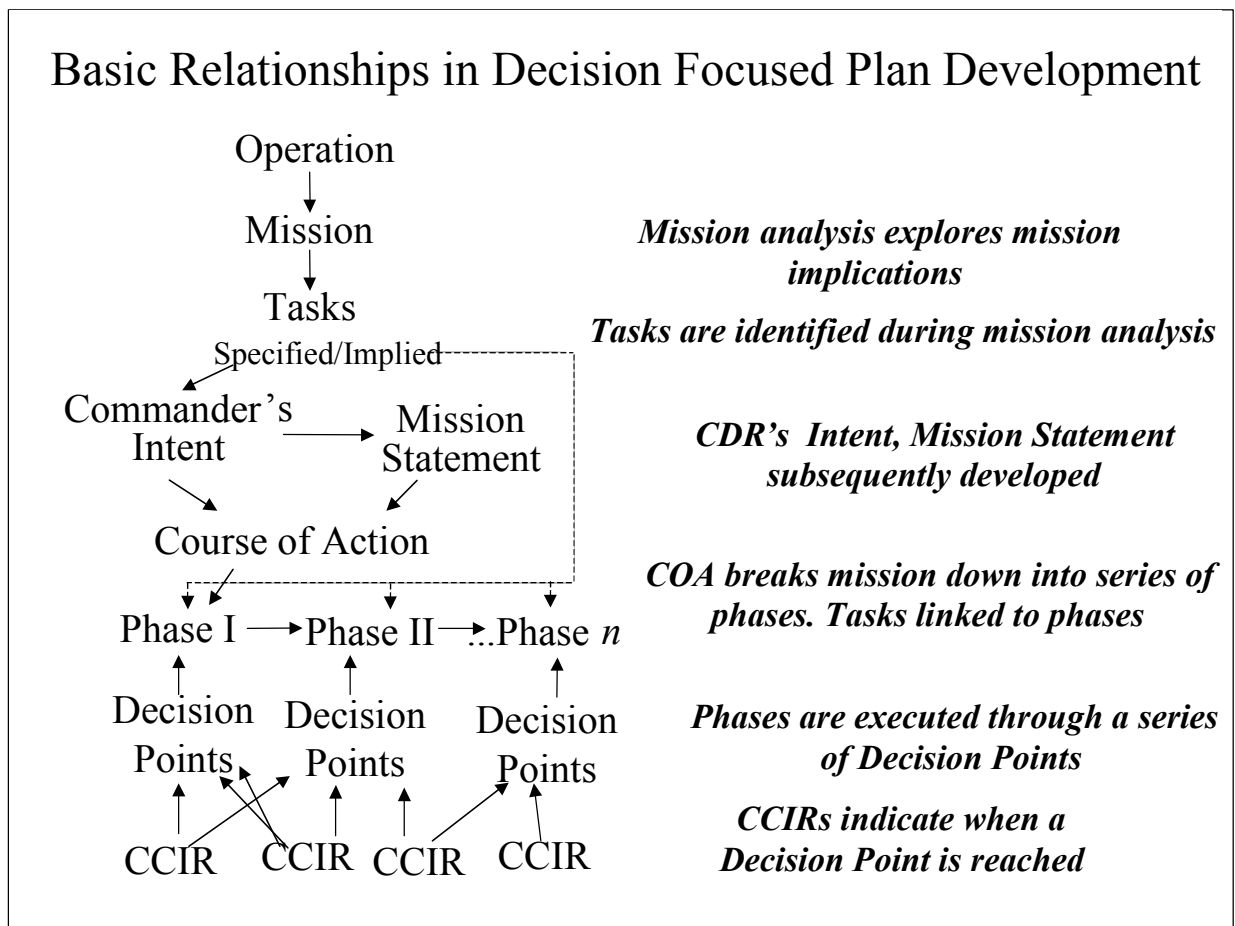

Figure I-2

The Impact of Decision Focus on Planning

DFC2 is intended to reduce the complexity in decision making by focusing the attention of the CDR and his or her staff on the state of plan accomplishment as it relates to the decisions he or she must make. Moreover, this decision making must be done within a certain timeframe that is unique to each decision The structure for this "just-in-time" decision making must be built into the plan from its conception. In analyzing the mission and separating the tasks to be

accomplished in response to it, planners must establish milestones for the phases of the mission and indications that these milestones are being achieved by the forces executing the plan.

The formal military planning process recognizes two categories of plans, either *deliberate plans* or *crisis action plans.*[1] Deliberate plans are crafted for anticipated operations or routine operations that occur frequently. Crisis action plans are developed by the RCC staff in response to unforeseen events demanding US military action. The goal of the planning process is the same in both cases: to produce a plan that articulates the tasks needed to accomplish a set mission. By orienting the CDR and the RCC staff to the state of plan accomplishment and the decisions needed to drive this accomplishment, DFC2 builds a structure of planning, monitoring, and information sharing around the CDR's decision making needs.

In setting the background for the discussion of how DFC2 can support both deliberate and crisis action planning at the RCC staff, two key points must be considered. First, the DFC2 approach bridges the planning process and the execution monitoring process through which the headquarters ensures that ongoing operations to execute the plan are conducted as called for by the plan and that the plan can be altered as needed during the course of operations. A second observation relative to the employment of DFC2 as the centerpiece of the RCC's planning and execution monitoring is the emphasis DFC2 places on a shared awareness of the plan as it is developed and executed. Supporting this shared awareness is the need for a highly collaborative environment to be built around the DFC2 technologies and employed by the RCC headquarters staff and those commands supporting the RCC's efforts. This implies the need for DFC2 to be implemented at those commands supporting the RCC. This facet of DFC2 has implications for how the DFC2 technologies should be installed and employed throughout the RCC's theater and DoD-wide. The DFC2 decision making context extends down to subordinate commands and outward to other RCCs and agencies supporting the plan.

DFC2 in Deliberate Planning
The responsibility for developing deliberate plans is assigned to the Plans and Policy Division, the J/G/S/N5 in most operational staffs. Since these plans must be sensitive to the national strategy and anticipate potential operations within the theater, deliberate plans are review and modified on an 18 month to two-year cycle. Deliberate plans cover a range of possible operations, from war plans to contingency plans for humanitarian relief. For the purposes of this operational concept, Theater Security and Cooperation plans (TSC) are also considered deliberate plans, as they are under the J5's purview and have a recurring review and modification cycle associated with them.

Figure I-3 depicts the process for developing a deliberate plan, based on the USPACOM organization. Establishing a Decision Context for a deliberate plan would be done by a J5 planner based on the subject of the plan. In order to ensure that contingencies are adequately planned for, a separate Decision Context would be established for each plan. The mission analysis for a deliberate plan produces a general COA that divides the mission into a series of phases as described above. For each phase, the J5-led planning team develops the DPs marking

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[1] The processes for developing deliberate and crisis plans are outlined in Joint Chiefs of Staff publications ("JCS Pubs") and are summarized in the *Joint Staff Officer's Guide,* commonly known as "The Purple Book," published by the Joint Forces Staff College.

the transit between phases and the supporting set of CCIRs. DFC2 uses this process to define a structured data environment that facilitates automation of information analysis.
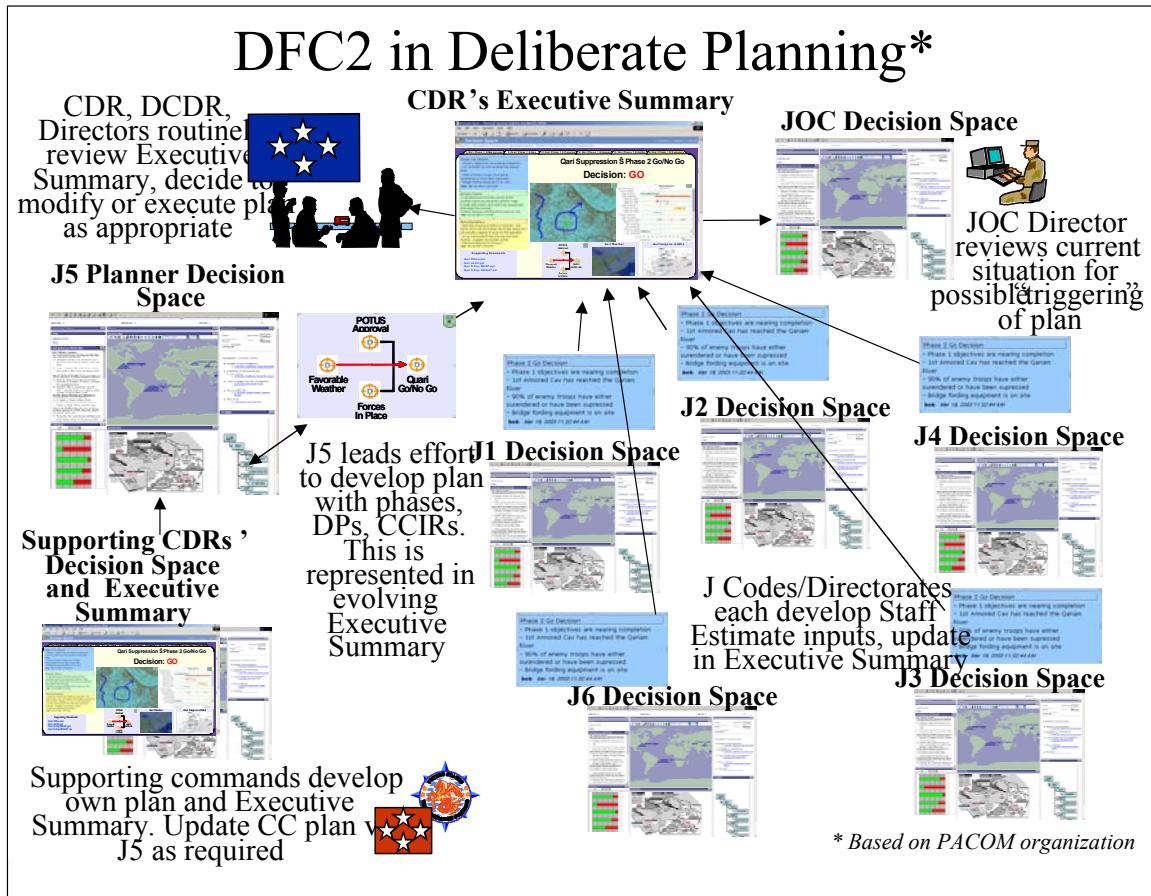

Figure I-3

The deliberate planning process requires Staff Estimates for a developing plan. Using their respective Decision Spaces within the Decision Context for a particular plan, the RCC directorates ("J Codes") would build their input to the Staff Estimate as part of an evolving Executive Summary for the plan. Under the Joint Operational Planning and Execution System (JOPES), commands outside the planning command may be assigned as "supporting" if they have a role in the plan. These commands and the RCC's component and subordinate commands are required to have their own supporting plans and these should be done in local Decision Spaces, with a Executive Summary generated for those commanders. The inputs from these commands would be used by the J5 in updating the RCC's planning. Because RCC plans require supporting plans be developed by both subordinate units and other RCC's with a role in the plan, the Decision Context would include these supporting plans.

The generation of a CDR's Executive Summary for a deliberate plan as part of its construction allows DFC2 to support the maturation and implementation of the plan. The JOC, or staff element assigned to monitor operations and conditions in the theater can do so with the plan in mind, watching for those conditions as reflected in the Executive Summaries that might "trigger" execution of the plan. The CDR and his Battle Staff (normally the Directors sitting with the

Deputy CDR as the CDR's advisors) can review the Executive Summary on a regular basis and recommend modification of the plan or operations based on it.

DFC2 in Crisis Action Planning
Crisis Action Planning ("CAP") is done in those cases where a short notice military response is needed to a situation not envisioned by a deliberate plan. In these cases, the CDR's staff must develop a plan on short notice, usually following a set of proceeds outlined in JOPES. The actual implementation of these procedures varied from command to command, although the basics are similar across most RCCs. In general, the responsibility for initiating CAP is assigned an intra staff cell under the direction of the J3. At the PACOM headquarters, this cell is known as the Operations Planning Team, or OPT. The OPT will monitor the state of the theater and, when the conditions calling for a rapid military response to crisis arise, will initiate CAP in accordance with the staff's Emergency Action Procedures (EAP).

As depicted in Figure I-4, DFC2 can support CAP planning from the first indication of a potential crisis, with the JOC's daily monitoring of the state of the theater in its Decision Space a matter of routine. As a potential crisis develops, the OPT is formed, with the OPT's Decision Space assuming the burden of the steps need for planning under a Decision Context established for the impending operation.[2] As the OPT guides the mission analysis process, the DPs and supporting CCIRs are generated, approved, and monitoring the plan is undertaken. A Crisis Action Team (CAT) will normally be formed to assist the JOC in monitoring operations and the CAT will, through its structure of Action Officers and "reachback" to key members of the staff, build the information required address each CCIR. Similarly, the Directorates will be able to view the plan's development and participate in the COA analysis needed for the CDR's final approval of the plan. As the OPT-led effort to develop the plan evolves, the CDR's Executive Summary associated with the plan is reviewed by the CDR and Battle Staff and initial decisions relating to the crisis are made: COA, force selection, deployment. A Joint Task Force (JTF) will often be formed to respond to the crisis and the JTF commander will, from his or her Decision Space, participate in the plan's development. This will normally be done by the formation of a Joint Planning Group (JPG) on the CJTF's staff, paralleling the OPT's organization at the RCC headquarters. Because the JTF is made up of temporarily assigned units in different home locations, the collaborative capability of the DFC2 in bringing the JPG and the JTF components together in the early stages of CAP is vital.

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[2] On Figure I-5, the Decision Space indicated for the plan development is labeled "Future Ops/Plans/OPT." The role of each of these groups is discussed in the following section.
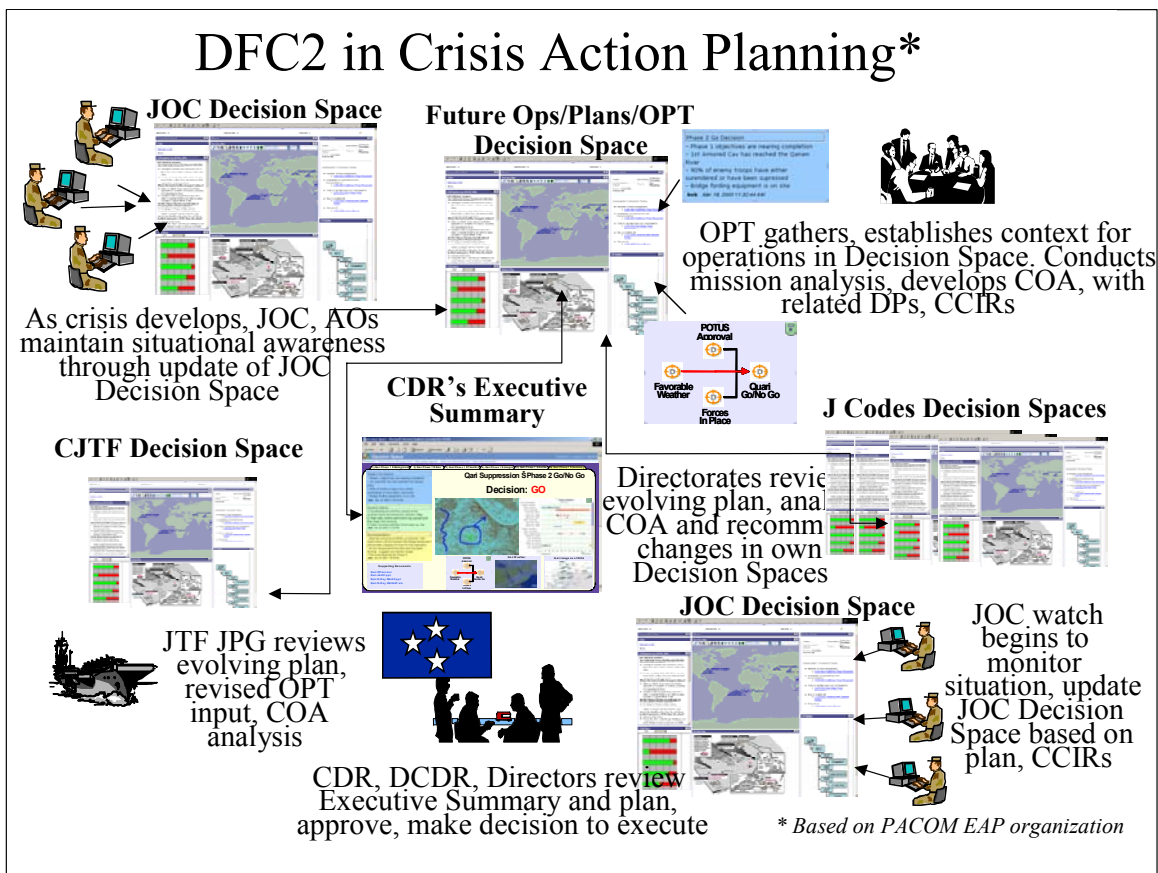
Figure I-4

DFC2 and Emerging Concepts for Joint Planning

As indicated above, the use of DPs as a foundation for planning is a relatively new concept and still finding its way into formal doctrine and procedures. However, formal doctrine is usually preceded by procedures instituted locally at individual commands, often reflecting new thoughts on how to best conduct operations in an increasingly volatile and unpredictable world. Because it binds information to the decision making process, DFC2 has the flexibility to support several of these new processes as they relate to planning.

Effects Based Operations

A new concept for operational planning currently receiving a great deal of attention is that of *effects based operations (EBO).* The philosophy behind EBO holds that the COA for a particular mission should be one that is directly applicable to the endstate objectives of the operation. While this seems intuitive, EBO theory extends the notion of "endstate" to the more precise effects that the commander wants to have his or her individual actions to have. This includes what have been commonly referred to as "unintended consequences" or secondary effects. EBO directly fits into the decision focused paradigm and the framework provided by the DFC2 Decision Space

EBO planning includes the analysis of the enemy's *centers of gravity (COGs),* or those elements of the enemy's forces or society most critical. Attacking these COGs will lead to a shorter, less costly operation, with the minimum expenditure of assets. This analysis must be comprehensive

and include a causal link between tasks and objectives. This causal analysis is extensive and the inability to fully analyze enemy COGs and determine the best way to affect them has led to present EBO efforts to be less than satisfactory. The Decision Space, with its highly collaborative analytic environment offers military planners the potential to conduct the in depth analysis EBO planning requires, with the analysis directly supporting DP development.[3]
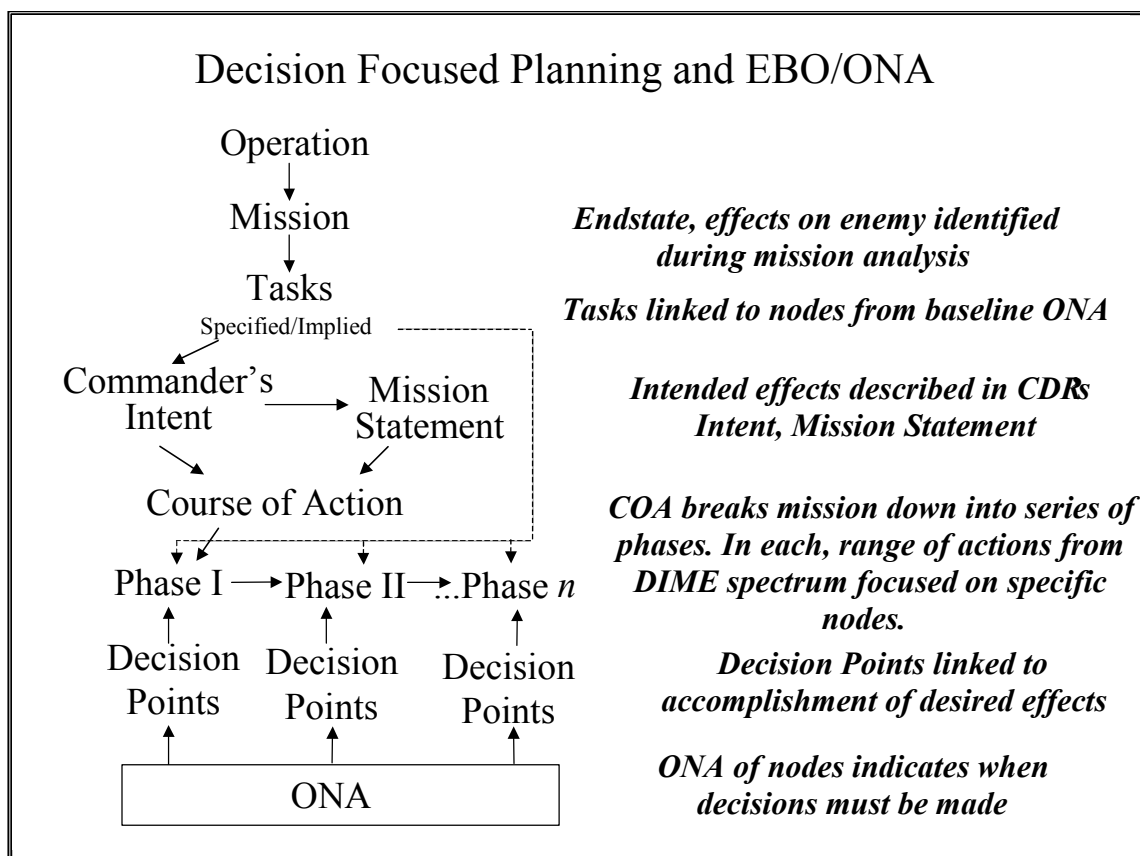
Complementing the EBO theory is the JFCOM-developed process of *Operational Net Assessment (ONA)*. ONA is the ongoing analysts of the effects operations are having on critical COGs and the impact of these effects on the accomplishment of the mission. The ONA process is an intense effort at collecting and analyzing data from multiple sources. The ONA process is intended to assess the impact operations are having on an adversary's effort across a spectrum: political, social, economic, military, infrastructure. ONA must be done by a multi-disciplined team with the expertise to assess data from multiple sources and integrate this information. The DFC2 Decision Space provides ONA analysts the collaboration, access to data, and analytic tools to link effects to operational decisions.[4]

Implementing EBO/OBA within the decision focused paradigm is achievable within the overall processes discussed in the concept document. The basic structure of decision points linked to the mission objectives and operational progress remains, with the EBO/ONA process anchoring planning, execution monitoring, and replanning efforts. In doing this, the mission and Commander's Intent are articulated in terms of *effects* the CDR wants to have on an opponent's critical *nodes*. Nodes, representing targeted COGs, are analyzed in a "System of Systems Analysis" (SoSA) that characterizes nodes as political, economic, military, social, Infrastructure, or information - PEMSII, in the EBO/ONA lexicon. The RCC's plan will target these nodes though a combination of diplomatic, information, military, or economic (DIME) efforts. These efforts will be linked to the desired effects on each node, appropriate to the plan. For example, destruction of an enemy's army might call for an effect such as destruction of his mechanized armor capability through a precision bombing campaign. Humanitarian relief operations might pursue the effect of gaining local support through an information campaign.

Figure I-5 indicates how the model for decision focused plan development is changed by EBO/ONA. While the plan must articulate intended effects at the outset, monitoring the accomplishment of the plan shifts from the CCIR model to that that of monitoring for the accomplishment of these effects. This subtle difference in information management within the RCC and subordinate headquarters essentially reorients the staff to thinking of decision points in terms of the attainment of specific effects. Should these effects not be achieved as the campaign progress, or should actions taken prove to have *unintended* or *second and third order effects*, the staff and commander will revise the plan to include different effects.

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[3] The US Air Force has been particularly active in developing EBO theory and has an ongoing initiative to develop EBO planning processes and information technology tools for their implementation. For a high level look at Air Force EBO concepts see http://www.aef.org/pub/psbook.pdf

[4] For a complete description of the ONA concept and how it supports EBO, see the *Standing Joint Force Headquarters Prototype Concept of Employment,* developed by JFCOM.

Decision Focused Planning and EBO/ONA

Operation

↓

Mission

Tasks

Specified/Implied

Commander's Intent → Mission Statement

Course of Action

Phase I → Phase II → ...Phase *n*

Decision Points   Decision Points   Decision Points

ONA

Endstate, effects on enemy identified during mission analysis

Tasks linked to nodes from baseline ONA

Intended effects described in CDR's Intent, Mission Statement

COA breaks mission down into series of phases. In each, range of actions from DIME spectrum focused on specific nodes.

Decision Points linked to accomplishment of desired effects

ONA of nodes indicates when decisions must be made

Figure I-5

The process of implementing EBO/ONA begins with the development of a *baseline ONA* in response to the mission and Commander's Intent. Current concepts call for this initial analysis of nodes and effects to be accomplished by a special SoSA group working within the RCC's *Standing Joint Force Headquarters* (SJFHQ). The SJFHQ is intended to support the quick transition of operational control of theater forces to a CJTF and to support interaction between the RCC's and CJTF's staff. As the plan is executed, the SJFHQ provides a linkage between RCC and CJTF in the ongoing analysis required to update the ONA and inform both commanders of the progress of the operation. The use of DFC2 tools can form the backbone of this effort, ultimately providing the CDR a constantly updated assessment of the status of operations and recommendations for decisions as they are needed.

Figure I-6 depicts how EBO/ONA would be conducted using DFC2 tools. As DIME "attacks" are directed at the opponent's nodes, the ongoing ONA effort is conducted in a collaborative environment under the direction of the *effects manager,* assigned from either the RCC's staff or the SJFHQ. This analysis is undertaken by the respective RCC and CJTF staffs, supported by the SoSA analysts, who, in turn, have access to experts in specific PMESII areas. Using DFC2 Executive Summaries as appropriate to individual concerns and responsibilities, AOs, the Joint Interagency Coordination Group (JIACG), OPT, etc. participate in and monitor the ongoing ONA process, focusing on those nodes an effects directly related to respective responsibilities. The goal is the development of a *Nodal Executive Summary* that the decision shaper will integrate into the CDR's Executive Summary.
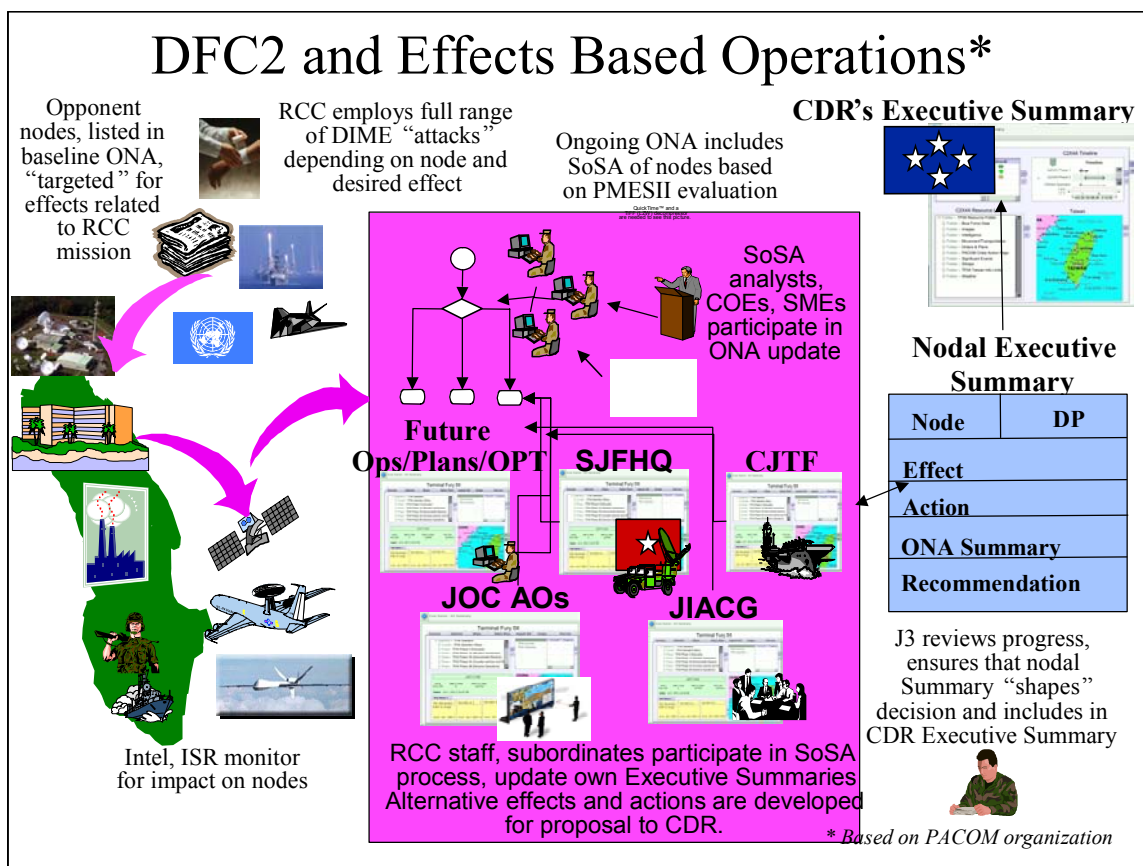
Figure I-6

Predictive Battlespace Awareness

In DFC2 planning DPs drive the generation of CCIRs and set the context for the gathering of the information necessary for decision shaping. This is a practical operationalization of the relatively new *Predictive Battlespace Awareness (PBA)* concept. PBA stipulates that the ISR assets should be "aimed" at data sources that will be needed to shape the CDR's situational awareness in the future. DFC2 can directly support this information "targeting" through the interrelationship between CCIRs and decision points.

While the linkage between DFC2 and PBA seems particularly applicable to intelligence data through the definition and monitoring of PIRs, the broad nature of CCIRs in contemporary humanitarian operations and limited conflicts requires that efforts to monitor them range beyond the usual intelligence efforts. This may require outside resources, extensive research, and time, burdening the Action Officer attempting to analyze the current state of a particularly arcane CCIR. A PBA approach to CCIR management using the DFC2 tools will allow the RCC staff to tailor its information gathering and analysis capability to ensure information resources are effectively employed.

Exercising Command and Control With DFC2

The DFC2 paradigm assumes decision making as the foundation of command and control, an assumption based on the DFC2 environment's ability to shape the commander's decision making. The previous section discussed establishing the conditions for decision making within

the DFC2 Decision Space. This section will outline the use of DFC2 in the key processes of managing operations. These are *execution monitoring, battle management, and re-planning.*

Execution Monitoring and DFC2
The concept for the use of DFC2 tools in monitoring the execution of operations has its foundation in the support they provide in developing the plan as outlined in the previous section. CCIRs are the centerpiece of this activity, which is focused on maintaining the CDR's Executive Summary on a continual basis.

Figure I-7 details the overall DFC2 process for execution monitoring at the RCC level. In maintaining the Executive Summary for the CDR and Battle Staff, the JOC's efforts are directed by the JOC Director through the JOC Ops watch section and the CAT, if formed. The primary task of the JOC is the management of information resources to support CCIR evaluation. The JOC watchstanders, under the direction of the JOC Director will be the focal point for this effort, but the power of the Decision Space construct is in its ability to support inclusion of Action Officers throughout the staff in updating the Decision Space. The expertise of the entire staff is leveraged in this approach, as Action Officers are free to reach beyond the JOC in their effort to analyze the CCIRs and state of decision making represented by them and the DPs. This virtual expansion of the JOC will include all of the directorates as well as the RCC headquarters' specialized command centers, such as the Theater Logistics Operations Center (TLOC). Additionally, the CJTF can update RCC-level CCIRs in support of the plan's DPs and resulting accomplishment.

Significantly, the process for execution monitoring is essentially the same regardless of whether the ongoing operation is the execution of a deliberate or crisis plan, or routine daily operations throughout the theater. In fact, most RCCs, like PACOM will find "routine" operations to be a diverse mix of all of these operational types: scheduled operations, usually based on the TSC plan will be conducted in one region of the theater, while in an other, a major exercise may be based on a contingency plan, and a crisis response operation is being undertaken somewhere else. The glue holding these disparate efforts together and allowing the CDR and staff to make effective and timely decisions relative to each is DFC2's ability to maintain the separate context for each operation, yet focus the CDR's attention on those decisions needing resolution.
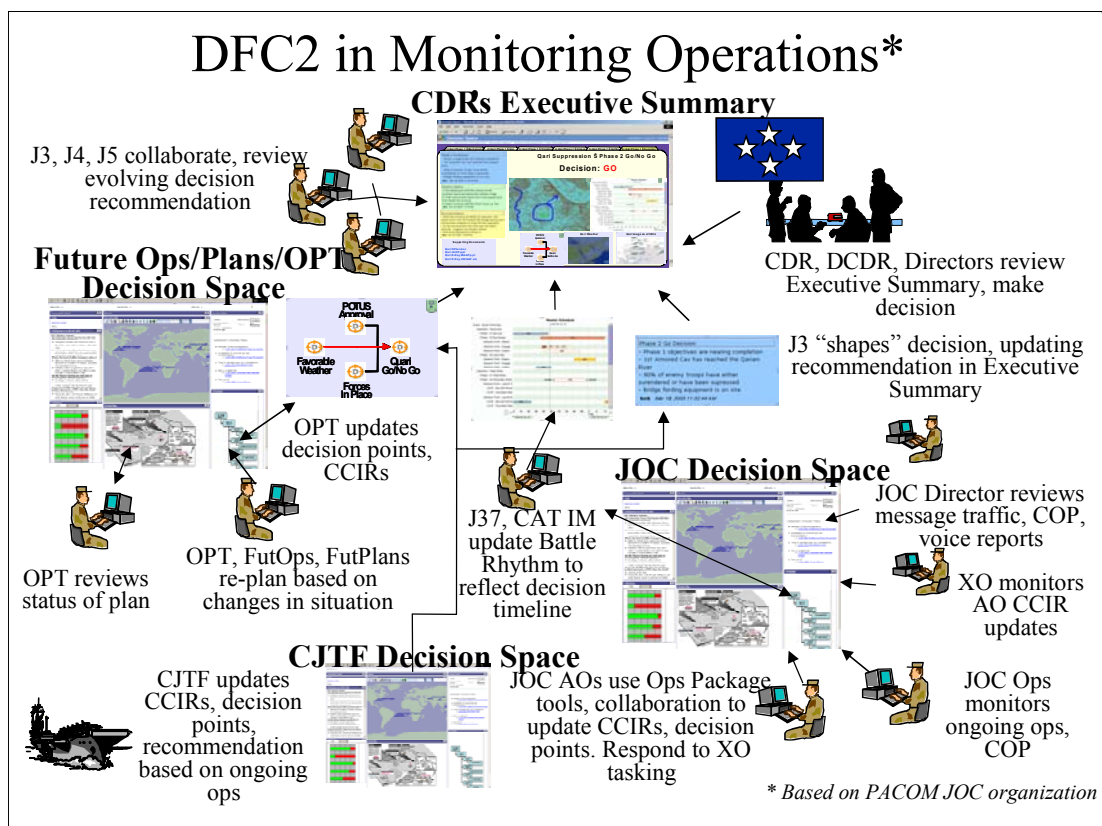
Figure I-7

Battle Management with DFC2

Commanders make decisions with an eye on the clock and the status of their forces. The trade-off between time and information is an essential element of practical command and control and commanders continually attempt to balance the problem of a good decision now as opposed to a better one later. Organizing and implementing the decision making process to address the intertwined issues of time and information is *battle management.* Effective battle management allows the CDR to make "just in time" decisions that give him or her the initiative.[5]

Decision Analysis

Battle management through DFC2 begins with the execution monitoring discussed above. While the JOC and supporting Action Officers will provide the technical analysis of information as it relates to the CCIRs and DPs, the task of shaping the CDR's Executive Summary will usually fall on a senior member of the Operations Directorate at a RCC staff, with the JOC Director fulfilling this role in the PACOM example. The analysis of CCIRs within the Decision Space must be shaped into a coherent CDR's Executive Summary that provides the CDR and Battle Staff a continually updated recommendation. This effort will become increasingly complex as

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[5] A common - although not universally accepted - model for time-sensitive decision making is the OODA Loop developed by the late Col. John Boyd. "OODA" stands for Observe, Orient, Decide, and Act, the cyclic process Boyd and his followers contend is the essence of seizing and maintaining the initiative against the enemy. A more detailed discussion of how this concept may be applied through DFC2 is included in Section 5. For a more extensive discussion of the OODA Loop and its implementation, see "The Essence of Winning and Losing," John R. Boyd, January 1996, Defense and the National Interest, http://www.d-n-i.net

information gaps develop during the course of operations, or as plans require changes. As the tempo of information gathering and CCIR analysis quicken and becomes confused by incomplete information and unexpected events, the JOC Director will likely call on a group of "decision analysts" to ensure that the CDR's Executive Summary is presenting an appropriate representation of the state of operations to the CDR, DCDR and Battle Staff. Because the CDR's Executive Summary will channel the CDR's attention to those decisions requiring his or her attention in a priority order, an independent analysis, free from the perceived notions of the plan and the confusion of the moment reflected in execution monitoring, is needed to provide a measured perspective on the decision making process. This analysis cell will operate within the Decision Space, focusing on the CDR's Executive Summary's final form.

Driving the Battle Rhythm
The term "battle rhythm" refers to the tempo of activity related to ongoing operations. Battle rhythm is usually considered a temporal framework, fitting the phases of an operation together to assist in coordination. At the staff headquarters level, battle rhythm has come to mean the tempo of daily activities in support of operations. This is usually interpreted as the CDR's and staff's daily schedule, detracting from the more operational concept of battle rhythm as the pace for the operation itself. Accordingly, terms such as *planning rhythm* and *staff rhythm* have begun to be used to refine the concept of managing time as a resource in operations.

DFC2's paradigm of continual focus on decision needed to advance the operational plan allows the concept of battle rhythm to take on a proactive sense. Having built tools specifically to depict the interrelationship of the plan, decisions and time, DFC2 enables the CDR to manage time as a resource. As shown on Figure I-7, part of the Decision Shaping function is updating and managing the battle rhythm view provided by DFC2. Linked to the CCIRs and DPs, the DFC2 Battle Rhythm provides an overview of the plan and its state. By active management in conjunction with execution monitoring and plan updating functions, an information manager from J37 can channel staff decision support activities through the DFC2 Battle Rhythm representation, which encompasses the RCC headquarters activities, those of supporting forces, the intended plan, and ongoing CCIR and DP analysis. This not only ensures that the CDR's Executive Summary is focusing attention on the current state of pending and critical decisions, but acts as an alert for additional planning.

Replanning and Plan Modification with DFC2
The need to respond to changing circumstances within the RCC headquarters is obvious; no plan can account for all contingencies and no plan will be executed exactly as envisioned. In accommodating this, RCC staffs usually form three cells to monitor the ongoing operation and respond with recommended changes to the plan. The first of these group is the usually the OPT. After overseeing the development of a CAP plan, or during the execution of a deliberate plan, the OPT will monitor plan execution on a continual basis, looking at the next 24 hours for needed changes to the plan. Future Ops cells are often formed at a RCC headquarters to maintain a focus on the plan execution in the 24 to 48 hours, and a Future Plans cell is often formed to monitor the plan over the course of the next 72 hours and beyond. Regardless of how the headquarters organizes itself to perform these functions, the same DFC2 Decision Space will be used for each operation and modifications to the plan will be based on the DFC2 paradigm: staff officers tasked with re-planning will analyze the trend in CCIRs, determine the impact on the stated plan,

revise the phases in the plan and develop new DPs and related CCIRs. These modifications will be reflected in the CDR's Executive Summary.

Established doctrine categorizes replanning efforts into two types. *Branches* are alternatives to the current plan, crafted as contingencies for execution if the plan needs major redirection during execution. *Sequels* are supplemental plans intended for follow on operations. Despite the distinct differences in branch in sequel plans, planning for each is often undertaken concurrently, during ongoing operations. Accordingly, the process for developing either must be efficient and time sensitive. Incorporating provisions for each can be done within the DFC2 paradigm.

Under DFC2, branch planning would be done within the same Decision Context as the current plan. Branch   planning would probably be initiated by the OPT and Current Ops cells, given the short notice nature of the requirement to develop the branch's COA. The CDR's Executive Summary would be expanded to incorporate the new COA developed at the branch plan. Since the branch would be executed in the midst of operations relating to the current operation, the CCIRs initiating the branch would in all likelihood be related to the current plan. The integration of DPs relating to the branch would ensure that its initiation and the transition to the operations called for in the branch would be relatively seamless. However, the CDR's Executive Summary would provide the CDR the ability to make a clear decision to execute the branch, based on the analysis of CCIRs.

Sequel planning is a more deliberate process, looking further into the future, although based on the current state reflected in the Decision Space. A sequel plan should be developed within its own Decision Context by the Future Plans cell. However, the current state of the operation must be "imported" into the new sequel's context to ensure sooth transition to the sequel. A sequel plan's COA and phase structure will likely be more complex than a branch's and the evolving CDR's Executive Summary needs to allow the CDR and Battle Staff as early an insight into the plan as possible. As in the case of the branch plan, the CCIRs relating the sequel may be based on the information being analyzed relative to the ongoing operation; however, the Action Officers and other analysts must be made aware of the existence and subtleties of the sequel plan and the long term implications for its execution. This will aid their transition to supporting the execution of the sequel once ordered by the CDR.

Implementing DFC2
The introduction of DFC2 technologies will have an obvious impact on the command processes of RCC, CJTF, and supporting staff headquarters with a subsequent need for these staffs to integrate DFC2 processes into headquarters routines. While this introduction will require some training on the concepts behind DFC2, and familiarization with the DFC2 tools, as indicated above, the foundation of the DFC2's use is consistent with current planning and command and control doctrine and practices. This section will describe how DFC2 personnel requirements and usage can be integrated into existing headquarters organizations and routines. As throughout this operational concept, the US Pacific Command is used as a model.

DFC2 and Command Organization
Combatant commands, JTFs, and component commands are staffed with experienced officers of all services with special training in planning and operations. The central concepts of DFC2,

Decision Points, CCIRs and the structure of military plans, will be familiar to these professionals, although the adoption of the DFC2 methodology will require staff officers to assume the functions outlined in the preceding sections. These functions, applicable in each of the uses of DFC2, can be generalized as *decision making*, approving the DFC2 process undertaken; *decision shaping*, ensuring the DFC2 process has produced a Executive Summary adequate for the decision maker's needs; *execution managing,* overseeing the DFC2 process and ensuing that the Decision Context and required Decision Spaces are built and updated; and *action officer* gathering and analysis of data within the Decision Space.

Because the processes DFC2 will be employed in are varied and require different participants from among the staff, these roles will change with the process undertaken. In matching the processes outlined in this operational concept with the notional PACOM headquarters organization, the assignments in Table 1 emerge as the most effective distribution of DFC2 duties.

		Decision Maker	**Decision Shaper**	**Action Officer(s)**	**Decision Support Manager**
Deliberate Planning	Plan Development	J5	J5 OPR	Intra staff team	J5 OPR
	Plan Approval	CDR	J54	J5 Plan OPR	J5 OPR
CAP	Plan Development	J3, J30	OPT Director	OPT	OPT Director
	Plan Approval	CDR	J3, J30	OPT Director	OPT Director
	Branch Planning	J3, J30	OPT Director	OPT	OPT Director
	Sequel Planning	J5	Future Plans	Future Plans Cell	OPT Director
Execution Monitoring	Plan Execution	CDR	J33	JOC Watch	JOC Director
	Routine Ops.	J3, J30	J33	JOC Watch	JOC Director

Table 1 – Notional PACOM DFC2 Roles in Various Command Processes

Incorporating DFC2 into Routine Headquarters Operations
The DFC2 process described in the previous section of this operational concept focused on the specific employment of DFC2 technologies and tools in the tasks of planning and managing forces. While these activities are the mainstay of a RCC's headquarters, DFC2 can provide a context for the routine activities of the headquarters. This will result in improved "businesses processes" throughout the staff as well as ensuring that the critical planning and command and control functions DFC2 will support during conflict are rooted in the daily activities of the staff.

Previous discussion highlighted the ability of DFC2 tools to facilitate the cyclic management of planning and execution functions of battle rhythm. The goal of battle rhythm is to synchronize operations across the various levels of participation. This is true of routine headquarters staff actions, as well: synchronization of the staff's disparate activities is a challenging, though

obviously necessary activity. DFC2 can provide an anchor for this synchronization, when applied in a model for staff activities built on the Observe, Orient, Decide, Act (OODA) concept. OODA envisions staff activities as centered around the elements indicated in an iterative fashion, known as the "OODA Loop." Figure I-8 depicts how the four functions of this paradigm would be served through DFC2 technologies.

The application of new technology to existing practice should ideally change the process implementing that practice. This change is often difficult for an organization for a variety of technical, cultural, and economic reasons. A common concern of leadership in this case is what the new technologies and process will "cost" or how much additional effort will be demanded of personnel by the implementation of the new technology. In these instances, the key factor should be the improvement in performance resulting from the new technology and improved process. DFC2 needs to be implemented with this factor in mind. While the use of DFC2 technologies and processes will require new roles and training for the staff, the resulting gain in effective decision making and command and control should make the transition worthwhile.
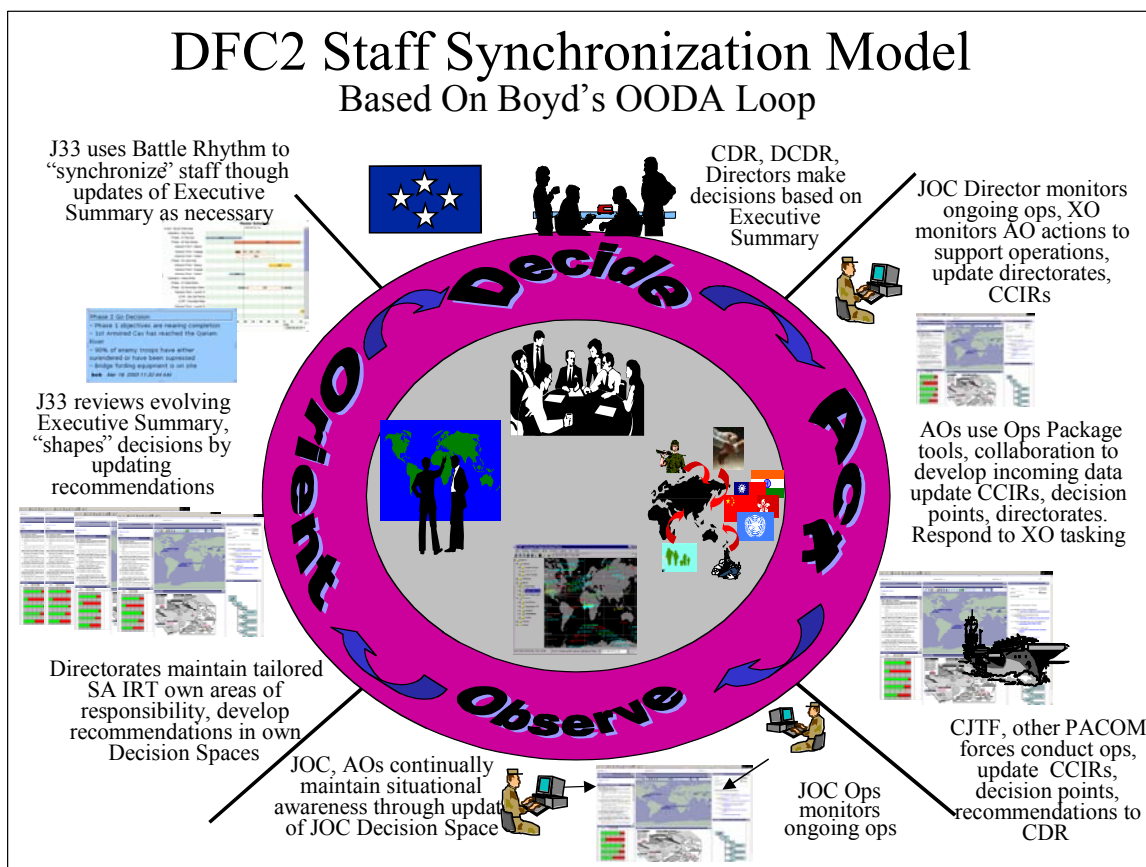

Figure I-8

DFC2 TECHNICAL OVERVIEW
System Description
The DFC2 system, composed of network servers and browser clients and associated software, supports force-level planning and execution built around the Decision Focused Command and Control concept. It provides the information content technology that makes dealing with

Decision Points, CCIRs, and Options organically manageable by the user. By linking processes, workflow, and the Decision Context, the system captures the Battle Rhythm in an automated format that goes beyond simple meeting schedules and briefings. The system serves as a database, collaborative tool, shared repository, planning tool, process management system, and visualization tool, all linked to Decision Points, CCIRs, and Options.

System Capabilities

- **Status Information**. A structured DFC2 information environment makes it much easier to automatically generate a rich set of status information on the progress of Joint Operations and Activities. End-Users will be able to define their own Status requirements and configure the DFC2 software application to automatically compute and maintain the results.

- **Alerts**. Users are able to define highly tailored alerts.

- **Search and Filtering**. The DFC2 system enables a wide range of powerful search and filtering capabilities. For example a Commander can ask the question. "Show me all Theater Engagement Decisions that occur in the next 72 hours that involve China and Japan." DFC2 search and filtering services can search through all Decision Points and return those that meet the state criteria.

- **Archiving**. It allows the Decision Making process to be captured and recorded. This enables subsequent playback and review of C2 performance and makes past Decision Making activities available to current activities. These capabilities can significantly enhance training, improve lessons learned, and provide case-base reasoning support to future C2 activities.

- **Workflow Management**. One can implement a wide set of workflow management services that include resource assignment, monitoring of work progress, analysis of staff workload, performance analysis, deadline tracking, and many others.

- **Collaboration.** DFC2, along with being able to share files, contains a text chat capability that allows users to hold on-line discussions. For example, the Decision Shaper might want to collaborate directly with an Action Officer to discuss the analysis and planning that was done for a specific Decision Point.

Decision Maker System Access
DFC2 provides the capability for information access across the headquarters organization, allowing decision makers, their supporting decision shapers and action officers the ability to manage information as required by respective assignment. Additionally, DFC2 allows members of the staff a consistent view of the battlespace, with a concomitant shared understanding of the operational environment.

- Decision Maker – As the individual that makes the decisions, the Decision Maker may or may not need direct access to the DFC2 system. As outlined earlier, the Decision Shaper would build the Executive Summary that enables the Decision Maker to evaluate the information and make a decision.

- Decision Shaper – In order to make the CDR's Executive Summary, the Decision Shaper will need to have full access to the system. Additionally, in his role of building and managing the Decision Context, the Decision Shaper will be the focal point for defining assignments, reviewing, aggregating information, building the CDR's Executive Summary format, data entry and collaboration with the Action Officers for clarification.

- Decision Support Manager – This role will require limited to full access to the system, depending on the work management processes and how tasks are assigned in relation to production, analysis, and planning activities. The Decision Support Manager may prefer an alternate method to ensure the quality and timeliness of CCIRs and Options, in which case DFC2 system access won't be required. However, the preferred method for carrying out this role would be to do it via the DFC2, utilizing the full capabilities of the system.

- Action Officer (AO) – Because the AO is expected to do the production work, perform the analysis, and generate plans, the AO will need enough access to the system to allow the deleting, editing, and adding of their production, analysis, and plans to the system.

Architecture

The basic DFC2 design allows users to access the system through a web browser, as depicted below. Though the DFC2 concepts can be implemented using a variety of technologies, the current DFC2 system has been designed with a focus on web-based services. By taking advantage of the Java specification, the system design is inherently portable, flexible, and scalable. Developer's can change or add to the functionality of the system, using software components built locally or by third-party vendors. The focus is on a network services architecture, where users aren't dependent on a specially designed workstation. The current configuration of DFC2 does not require unique client software, only a compliant browser. The architecture is depicted in Figure II-1.
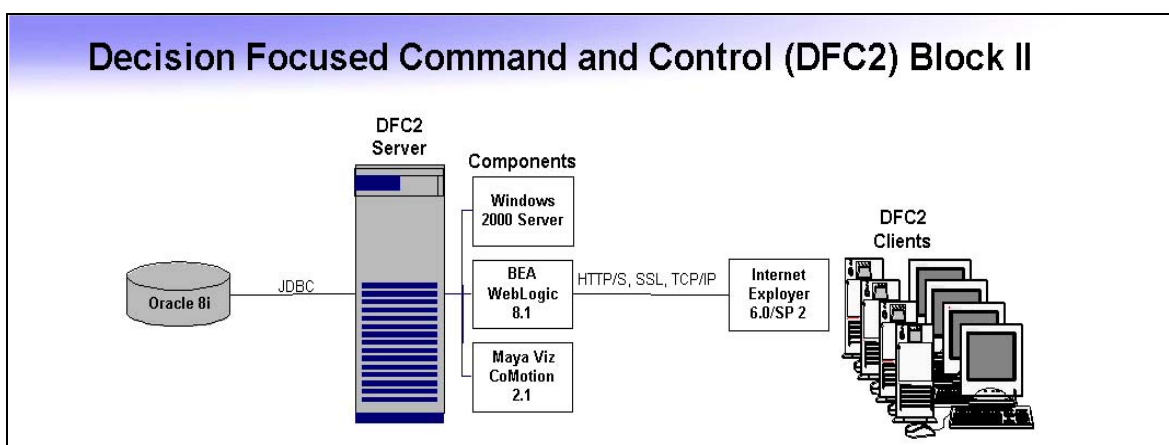

Figure II-1

Client/User Requirements

Client Hardware

There are no unique hardware requirements beyond a basic PC. Minimum system requirements are: 486/66-Mhz processor; 32 MB of RAM; 12 MB of hard disk space; and Super VGA (800 x 600) monitor with 256 colors.

Client Software

The only software required on a client system is a browser, Internet Explorer or Netscape Navigator, and the downloadable Java Plug-in.

DFC2 Server Requirements

Server Hardware (Baseline Configuration)

- Oracle 8i Server – SUN Microsystems V480, 4 processor, 900Mhz

- WebLogic/Maya Viz Server – Dell PE2650, single processor, 2 RAID, 2.8Ghz, 6.6GB RAM, 73GB HD

Server Software

The DFC2 server uses Windows 2000 as its operating system and Oracle 8i (version 8.1.7 enterprise edition) as its database. DFC2 also includes MAYA Viz's CoMotion and BEA's WebLogic software.

MAYA Viz's CoMotion 2.1 – www.mayaviz.com

CoMotion is a Java-based software toolkit that provides sophisticated visualization components to create interactive, analytic, and collaborative environments. Users can manipulate data in one location, and instantly see their changes reflected across one or more collaborative workspaces in real time, using live data. In addition, it allows routine and exploratory analysis; evaluation of alternative courses of action; zooming between macro and micro views of a situation; and the movement of data from one visualization display to another.

By dragging data into a shared visualization, one person provides access to that data to all other people working with the visualization. Each user can drill down into the new data, exposing more or less detail as the collaborative analysis requires. In addition, any user can draw on the visualization with electronic ink, add a sticky note, and mark or "paint" a data point to call attention to a particular trend, or condition.

BEA WebLogic Server 8.x – www.bea.com

This is a Java-based Web application server and Web server, which provides an environment to build, integrate, secure, and manage server-side Java applications. It supports extensible markup language (XML) applications. DFC2 takes advantage of XML by electronically tagging Decision Points, CCIRs, etc., making the information easier to query and search. In addition WebLogic provides full-feature security services that enable an administrator to control access to all applications and components.

Development Process/Milestones

Development on DFC2 started in March 02, 2003, with the goal of providing a tool that automates Decision Focused Command and Control for RCCs and JTF Commanders. Block I was completed in November 2002. Block II versions A through E, currently under development, are scheduled for delivery through FY04. The CINC 21 ACTD and software development concludes at the end of FY04.

System Development

Technology Transition

DFC2 capabilities are expected to be transitioned into the future Joint Command and Control (JC2) (follow-on to GCCS) and Deployable Joint Command and Control (DJC2) programs.

Future Enhancements

Because this ACTD is programmed to end in FY04, any future enhancements will need to be developed locally or by the programs of record (e.g. JC2, DJC2, etc.) that it transitions to.

Support Requirements

User Support

Users are expected to contact their local help desk to get technical assistance. Since there is no unique DFC2 client software, and utilizes a standard browser, users should not be required to understand the technical intricacies of the DFC2 system.

Network Administration Support

Local network administrators maintain the servers with help from program funded contractor support. Problems associated with the hardware and software can also be addressed by the CINC 21 helpdesk. Each DFC2 server site should have an experienced Windows systems administrator

and preferably personnel who have familiarity with Oracle 8i, BEA WebLogic, and Maya Viz CoMotion software.

Operations and Maintenance

The CINC 21 Technical Manager will bundle the initial hardware and software. After the program ends in FY '04, any upgrades to software and life-cycle replacement of the hardware will be done by the local command or programs of record. Technical support, after '04, will be provided by the sponsoring programs of record.

Glossary

ACTD	Advanced Concept Technical Demonstration
C2	Command and Control
CAP	Crisis Action Planning
CCIR	Commander's Critical Information Requirement
CDR	Commander
CINC	Commander-in-Chief
CJTF	Commander Joint Task Force
COA	Course of Action
COE	Center of Excellence
COG	Center of Gravity
DFC2	Decision Focused Command and Control
DIME	Diplomatic, Information, Economic, Military
DISA	Defense Information Systems Agency
DoD	Department of Defense
DP	Decision Point
EAP	Emergency Action Procedures
EBO	Effect Based Operations
EEFI	Essential Element of Friendly Information
EEI	Essential Element of Enemy Information
FFIR	Friendly Force Information Requirement
GCCS	Global Command and Control System
IATO	Interim Authority to Operate
JC2	Joint Command and Control System
JIACG	Joint Interagency Coordination Group
JOC	Joint Operations Center
JOPES	Joint Operational Planning and Execution System
JPG	Joint Planning Group
JTF	Joint Task Force
OM	Operational Manager
ONA	Operational Net Assessment
ONR	Office of Naval Research
OODA	Observe, Orient, Decide, Act
OPT	Operational Planning Team
PACOM	US Pacific Command
PBA	Predictive Battlespace Awareness
PEMSII	Political, Economic, Military, Social, Infrastructure, Information
PIR	Priority Intelligence Information
RCC	Regional Combatant Commander
SJFHQ	Standing Joint Force Headquarters
SME	Subject Matter Expert
SOP	Standard Operating Procedures
SoSA	Systems of Systems Analysis
STRATCOM	US Strategic Command

TLOC	Tactical Logistics Operations Center
TM	Technical Manager
TSC	Theater Security and Cooperation
USPACOM	US Pacific Command
XML	Extensible Markup Language